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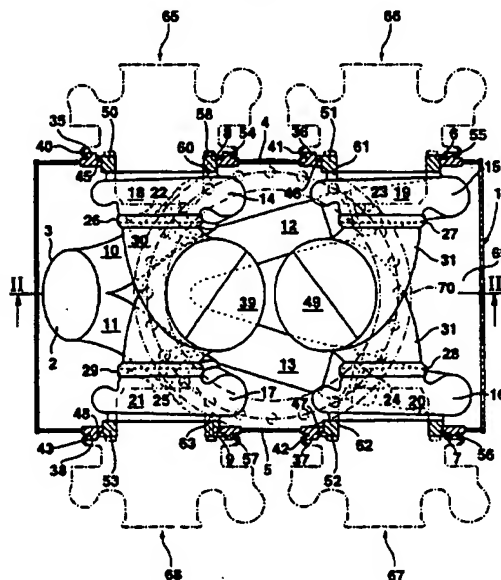
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(54) Mounting exhaust-driven turbochargers on a support housing

(57) The invention provides a method and apparatus for mounting exhaust-driven turbochargers on a support housing which is disposed on an internal-combustion engine. The support housing has opposite side walls (4,5) with openings (6,7,8,9), which are preferably arranged in pairs coaxially to one another, for mounting exhaust-driven turbochargers, of which respective turbine housings (18,19,20,21), associated exhaust ducts (10,11,12,13) and exhaust outlet ducts (30,31) in one piece are disposed in pairs inside the support housing (1), and a respective unit (65,66,67,68) comprising compressor, bearing housing, and rotor mounted in the bearing housing and the associated air-charge ducts are disposed outside the support housing (1). The one-piece support housing (1) contains in the openings (6,7,8,9) intermediate rings (50,51,52,53) which are displaceably guided axially in the openings (6,7,8,9) and have means (58,54,55,56,57) with which the turbine housings (18,19,20,21) are secured to the support housing (1).

Fig. 1



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### Fig. 1

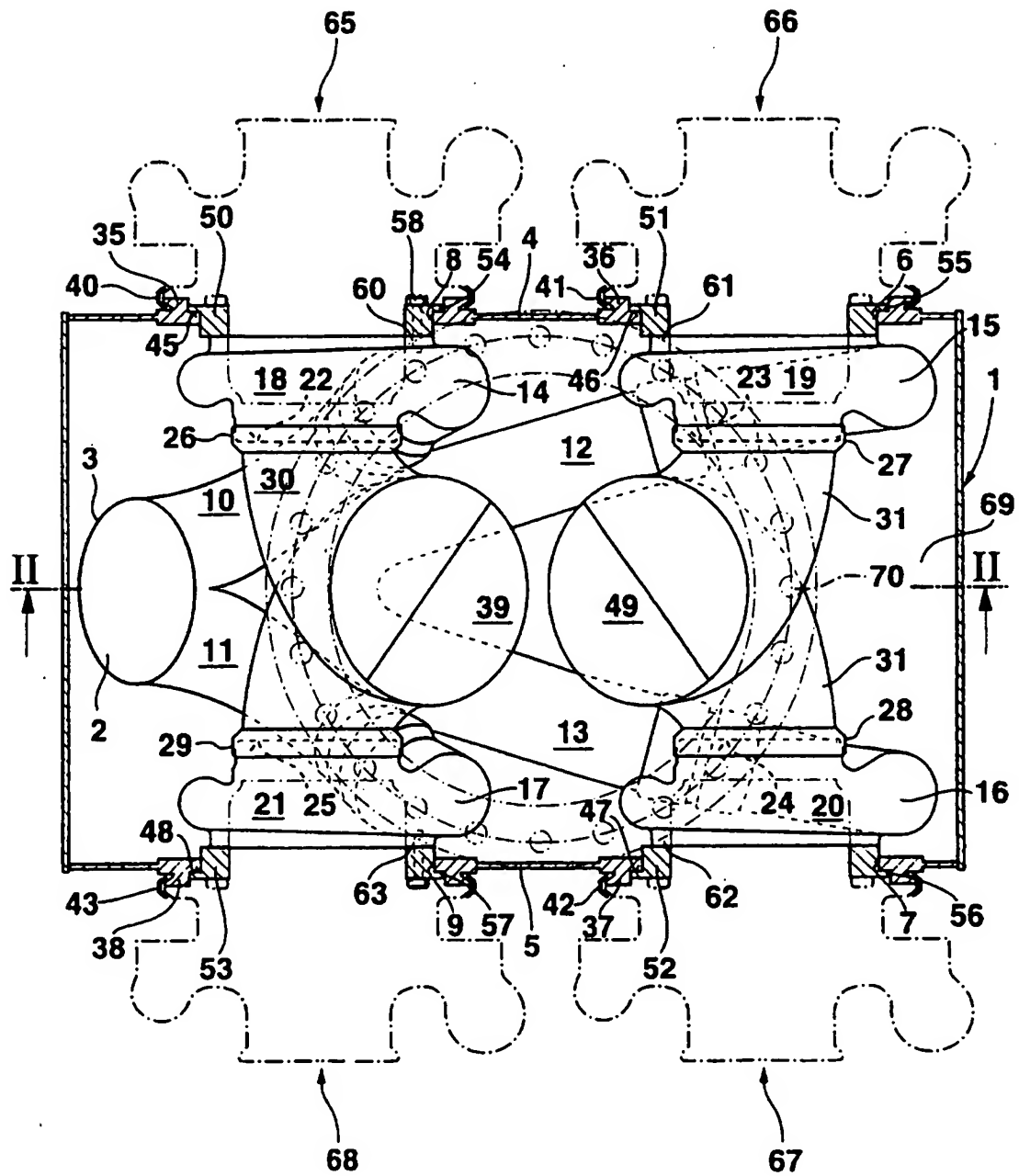
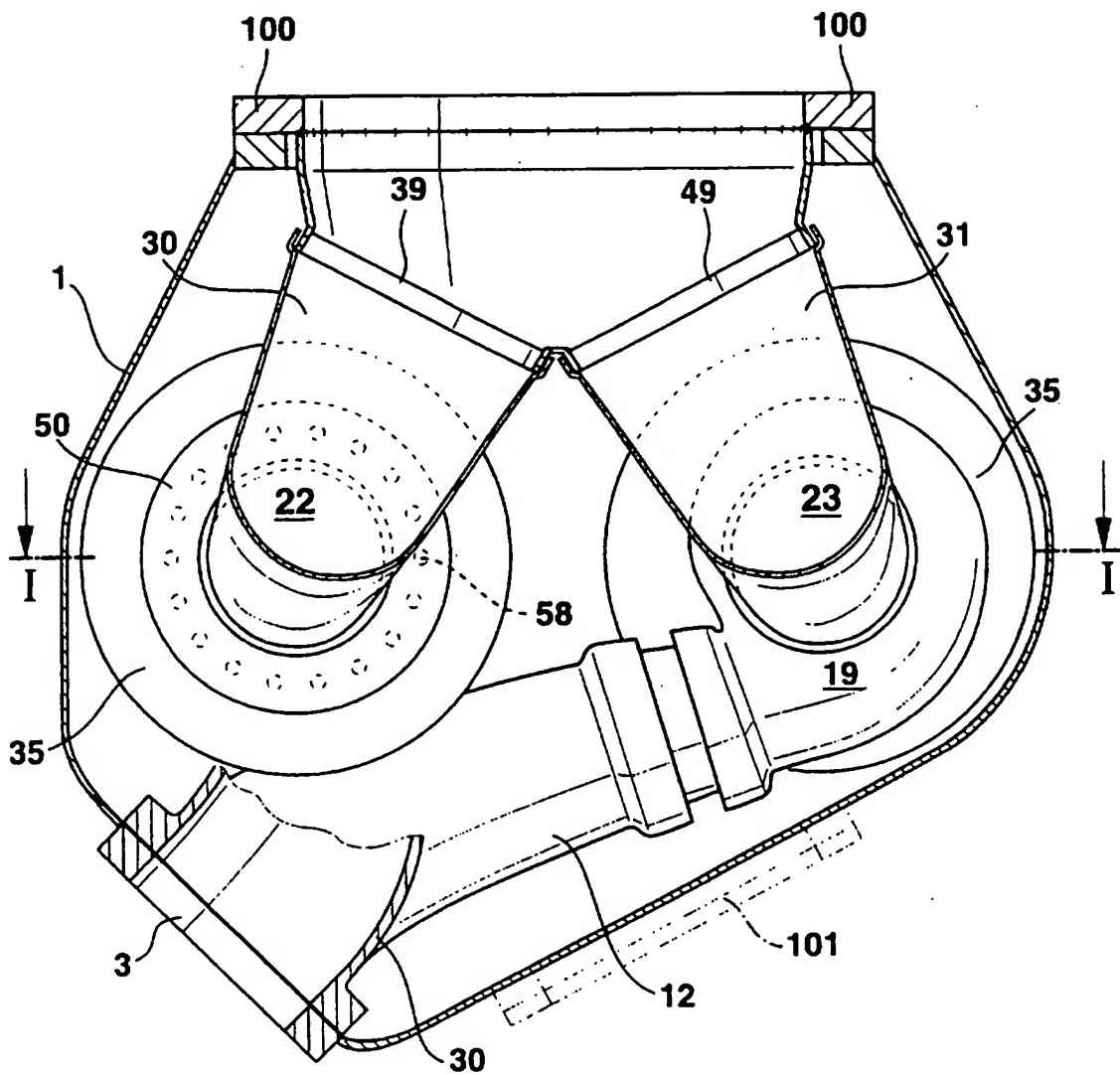


Fig. 2



Method and apparatus for mounting exhaust-driven  
turbochargers on a support housing

The invention relates to a method and apparatus for mounting exhaust-driven turbochargers on a support housing having the features of the preamble of Claim 1.

In internal-combustion engines with exhaust-gas forced induction it is possible for the forced-induction conditions to be improved under partial load operation by operating a plurality of exhaust-driven turbochargers in parallel when there is high exhaust gas production and by shutting down some of the exhaust-driven turbochargers when there is reduced exhaust gas production. The arrangement of a plurality of exhaust-driven turbochargers with their exhaust ducts and their air inlet and air outlet ducts is difficult to provide from a structural point of view.

It is known from DE-C2 30 05 655 to arrange on an internal-combustion engine a plurality of exhaust-driven turbochargers, each of which comprises an exhaust-driven turbine and a compressor connected therewith, and which are mounted on the internal-combustion engine by means of a support device. The support device has boxes which are mounted on the internal-combustion engine. Exhaust-driven turbochargers are arranged in pairs coaxially with their respective associated exhaust ducts arranged internally in openings in side walls, and their respective compressors and associated air-charge ducts arranged outside the boxes. The inlet openings of one-piece exhaust outlet ducts are displaced transversely during assembly in front of two outlets of two turbine housings, which are respectively coaxial to one another. Boxes according to the aforementioned state of the art have drawbacks in the installation of the exhaust-driven turbochargers and are relatively expensive to produce. Moreover, sealing of the boxes is expensive because of a complicated seal path.

An object of the invention is to devise a method and apparatus for mounting exhaust-driven turbochargers on a support housing, whereby installation of the exhaust-driven turbochargers is simple, production is inexpensive and sealing problems are substantially obviated.

5           This object is achieved by an apparatus for mounting exhaust-driven turbochargers on a support housing having the features of Claim 1 and by a method for mounting exhaust-driven turbochargers on a support housing having the features of Claim 5.

10           According to the invention, an apparatus for mounting exhaust-driven turbochargers has a one-piece support housing which is disposed on an internal-combustion engine. Opposite side walls of the support housing have preferably coaxial openings for mounting exhaust-driven  
15           turbochargers, wherein respective turbine housings and associated exhaust ducts are provided inside the support housing and a respective unit comprising compressor, bearing housing, and rotor mounted in the bearing housing and the associated air-charge ducts are provided externally of each  
20           turbine housing. The one-piece support housing contains in the coaxial openings intermediate rings which are displaceable outwardly and axially relative to the coaxial openings, and the outer periphery of which is provided with radial guide surfaces which co-operate with radial inner  
25           surfaces of the openings. The openings in the support housing are of such a size that turbine housings arranged opposite one another in pairs inside the support housing can be displaced in axially opposite directions to one another to some extent, so as to enable associated one-piece exhaust  
30           outlet ducts to be introduced in pairs between the turbine housings through respective openings. The intermediate rings are secured to the turbine housings and the units comprising the intermediate rings and the turbine housings are displaced in pairs axially to one another so as to effect an  
35           overlapping connection between a respective outlet of a turbine housing and a sleeve of the associated exhaust

outlet duct. The turbine housings are secured to the intermediate rings on the support housing. The unit comprising compressor, bearing housing, and rotor mounted in the bearing housing is respectively inserted from the outside of the support housing through the opening into each turbine housing and is fastened to the support housing. The apparatus according to the invention for mounting exhaust-driven turbochargers makes it possible for the support housing to be produced inexpensively in one-piece with only a small installation opening. Sealing problems are largely obviated since the seal path is simple.

According to an advantageous development of the invention, the intermediate rings are formed of glass ceramic material for the purpose of reducing heat transmission.

The intermediate rings of the apparatus for mounting exhaust-driven turbochargers have stop members which are applied against the support housing and are detachably fastened by means of screws to the turbine housing so that production of the intermediate rings is simple and installation is possible using conventional means.

According to another advantageous development of the invention, the hollow spaces of the support housing are dry insulated with silicate wool or are foamed with insulating compound.

According to the invention, a method of mounting exhaust-driven turbochargers on a support housing in accordance with Claim 5 has the following steps: arranging turbine housings in the support housing, displacing the turbine housings axially outwards through preferably coaxial openings in the side walls of the support housing, installing intermediate rings on the turbine housings, positioning in the support housing the exhaust ducts belonging to the turbine housings, displacing the turbine housings axially inwards relative to the support housing, the intermediate rings being guided in the coaxial openings so that in each case one outlet of a turbine housing

discharges coaxially and in an overlapping manner into a sleeve of the associated exhaust outlet duct, inserting a unit comprising compressor, bearing housing, and rotor mounted in the bearing housing from outside of the support housing, and connecting the unit to the support housing. The method according to the invention is simple and inexpensive.

The invention will be illustrated below with reference to one example of embodiment, wherein:

Figure 1 shows a cross-section through a support housing with exhaust-driven turbochargers and associated exhaust ducts according to the invention, viewed in the direction of the section lines I-I indicated in Figure 2, and

Figure 2 shows a view of the support housing according to the invention in the direction of the section lines II-II indicated in Figure 1.

With reference to the drawings, a one-piece support housing 1 is provided on an internal-combustion engine (not shown). An exhaust manifold 2 of the internal-combustion engine discharges into the support housing 1 at an inlet 3. The support housing 1 has opposite side walls 4 and 5 which respectively include two pairs of openings 6,7,8 and 9, the openings of each pair being situated coaxially opposite one another.

The exhaust manifold 2 is connected with exhaust ducts 10,11,12 and 13 which discharge in a gas-tight manner into a respective inlet 14,15,16 and 17 of turbine housings 18,19,20 and 21, the contour lines of which are indicated. The turbine housings 18,19,20 and 21 are arranged opposite one another in pairs in the openings 6,7,8 and 9. Exhaust gas is directed centripetally into the turbine housings 18,19,20 and 21 via turbine blades to a respective outlet 22,23,24 and 25 of the turbine housings 18,19,20 and 21. The outlets 22,23,24,25 are arranged coaxially opposite one another in pairs.

One-piece exhaust outlet ducts 30,31 are fitted in pairs on to the outlets 22,23,24 and 25 by means of coaxial sleeves 26,27,28 and 29 overlapping the outlets 22,23,24 and 25. The one-piece exhaust outlet ducts 30,31 in pairs discharge into outlet openings 39,49. The outlet openings 39,49 of the exhaust outlet ducts discharge into a diffuser insert 100, as illustrated in Figure 2. The diffuser insert can be formed in one-piece with the support housing 1. If, as illustrated, the diffuser insert is in the form of a separate part, a corresponding diameter is available in the support housing for use as an installation opening when the diffuser insert has been removed, through which the exhaust outlet ducts 30,31 can be introduced into the support housing. If the diffuser insert is formed in one-piece with the support housing, a separate installation opening 101 is provided which is illustrated in chain line. The diffuser insert, which is illustrated in chain line in Figure 1 since it is situated above the intersecting plane, can be connected to an exhaust duct by screws 70.

The opposed openings 6,7,8 and 9 are provided with reinforced rims 35,36,37 and 38 respectively which are provided radially on the outside with grooves to accommodate V-bands 40,41,42 and 43. The reinforced rims 35,36,37 and 38 have radial mounting surfaces 45,46,47 and 48 on the inside.

Intermediate rings 50,51,52 and 53 are provided with radial abutment surfaces 54,55,56 and 57 on the outside, which co-operate with the mounting surfaces 45,46,47 and 48, the intermediate rings 50,51,52 and 53 being displaceable axially into the openings 6,7,8 and 9 respectively. The diameter of the outer circumference of the intermediate rings 50,51,52 and 53 corresponds to the diameter of the openings 6,7,8 and 9 respectively so that the intermediate rings 50,51,52 and 53 act as guide members in the openings 6,7,8 and 9. The intermediate rings 50,51,52 and 53 include screws 58 which are arranged axially and are screwed into corresponding threads in the turbine housings 18,19,20 and 21 and thus secure the turbine housings 18,19,20 and 21



relative to the support housing 1. The intermediate rings are formed of glass ceramic.

A respective unit 65,66,67 and 68 comprising compressor, bearing housing and rotor mounted in the bearing housing can be inserted from outside the support housing 1 into a respective turbine housing 18,19,20 and 21 and can be connected to the support housing 1 by means of the V-bands 40,41,42 and 43 respectively which engage in the grooves of the reinforced rims 35,36,37 and 38. The units 65,66,67 and 68 are each illustrated in outline in chain lines.

Hollow spaces in the support housing 1 are filled in this embodiment with silicate wool 69.

The method of mounting the exhaust-driven turbochargers will now be described.

The support housing 1 is mounted on the internal-combustion engine. Turbine housings 18,19,20 and 21 are introduced into the support housing 1 so that the axes of rotation of the turbine housings 18,19,20 and 21 are in each case arranged approximately coaxially to the centre axes of the opposed openings 6,7,8 and 9. The turbine housings 18,19,20 and 21 are each moved axially outwards through the coaxial openings 6,7,8 and 9. The one-piece exhaust outlet ducts 30,31 arranged in pairs are then positioned with the respective coaxial sleeves 26,27,28 and 29 inside the support housing 1.

The intermediate rings 50,51,52 and 53 are screwed to the turbine housing flanges 60,61,62 and 63 respectively. Subsequently, the turbine housings 18,19,20 and 21 are moved relative to the support housing 1 axially inwards through the openings 6,7,8 and 9 until a respective outlet 22,23,24 and 25 of a turbine housing 18,19,20 and 21 discharges coaxially, overlapped by the sleeves 26,27,28 and 29, into the associated exhaust outlet ducts 30,31. The respective abutment surfaces 54,55,56 and 57 of the intermediate rings 50,51,52 and 53 bear on the mounting surfaces 45,46,47 in the coaxial openings 6,7,8 and 9 from outside the support

housing 1 and the turbine housings 18,19,20 and 21 are secured relative to the support housing 1.

Subsequently, the respective units 65,66,67 and 68 comprising compressor, bearing housing and rotor mounted in the bearing housing are inserted from outside the support housing 1 into the turbine housings 18,19,20 and 21 and the air-charge ducts are connected. The units 65,66,67 and 68 are securely connected to the support housing 1 by means of the V-bands 40,41,42 and 43, each of which engages in grooves in the reinforced rims 35,36,37 and 38, securely connected to the support housing 1. The exhaust ducts 10,11,12,13, which can be disposed in the support housing before the other units are introduced, are placed in position by displacement, and rotation of the turbine housings may optionally also be carried out.

CLAIMS

1. An apparatus for mounting exhaust-driven turbochargers on a support housing (1) which is disposed on an internal-combustion engine and has opposite side walls with openings for mounting exhaust-driven turbochargers, of which respective turbine housings, associated exhaust ducts and at least exhaust outlet ducts in one piece in pairs are provided inside the support housing, and a respective unit comprising compressor, bearing housing, and rotor mounted in the bearing housing and the associated air-charge ducts are provided outside the support housing, wherein the one-piece support housing contains in the openings intermediate rings which are displaceably guided axially into the openings and have means with which the turbine housings can be secured to the support housing.
2. An apparatus for mounting exhaust-driven turbochargers according to Claim 1, wherein the intermediate rings are formed of glass ceramic material.
3. An apparatus for mounting exhaust-driven turbochargers according to Claim 1 or Claim 2, wherein abutment surfaces of the intermediate rings are applied against mounting surfaces of the openings and are each detachably fastened by means of screws to a respective turbine housing.
4. An apparatus for mounting exhaust-driven turbochargers according to any one of Claims 1 to 3, wherein hollow spaces in the support housing (1) are filled with silicate wool or are foamed with insulating compound.
5. A method of mounting exhaust-driven turbochargers on a support housing according to Claim 1 with the steps of: arranging opposing turbine housings in the support housing, displacing the turbine housings in each case axially outwards through openings in side walls of the support

housing, arranging intermediate rings in the openings from outside the support housing, connecting the intermediate rings and the respective associated turbine housings, positioning in the support housing the one-piece exhaust ducts belonging to the turbine housings, displacing the turbine housings axially inwards, the intermediate rings being guided in the openings so that in each case one outlet of a turbine housing discharges coaxially and in an overlapping manner into a respective sleeve of the associated exhaust outlet ducts, inserting a unit comprising compressor, bearing housing, and rotor mounted in the bearing housing from the outside of the support housing, and connecting the unit to the support housing.

6. An apparatus according to any one of Claims 1 to 4, wherein a diameter in the support housing used as an installation opening is provided with a detachable diffuser insert for the connection of exhaust outlet ducts.

7. An apparatus for mounting exhaust-driven turbochargers on a support housing substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

8. A method of mounting exhaust-driven turbochargers on a support housing substantially as hereinbefore described with reference to the accompanying drawings.